A
PROJECT REPORT
ON

Cold Chain – A Monitoring Unit

Submitted by

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Under the guidance of

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ELECTRONICS AND TELECOMMUNICATION ENGINEERING
WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
2021-22

CERTIFICATE

This is to certify that seminar entitled

COLD CHAIN-A COMPLETE MONITORING SYSTEM

Submitted by

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has been approved as the partial fulfillment for the award of 'Bachelor of Electronics and Telecommunication Engineering' by **Punyashlok Ahilyadevi Holkar Solapur University, Solapur** in the academic **year 2021-22**.

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2021-22

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The project has certainly enlightened us with the modern era of technologies & it has boosted our confidence. The project work has certainly rendered us tremendous learning as well as practical experience.

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ABSTRACT

India is the second largest producer of fruits and vegetables, largest producer of milk and one of the leading producers of meat and fish. Owing to its diverse agro-climatic zones and resources, the production of these commodities not only extends in quantity, but also to a wide variety of them. Despite these merits, India is also one of the leading countries in terms of food loss, even though a sizeable share of the population is suffering from hunger and malnutrition. The farmers in India, even though they are producing the largest quantities of the fore- mentioned agricultural and horticultural produce, their economic situation is not really presenting a happy picture. Compared to developed nations, the Indian agricultural scenario is very complex and so are the reasons leading to this situation. Among all, the important reasons in leading to the high quantities of food loss are poor post-harvest care, highly complex and inefficient supply chains, lack of storage and processing infrastructure

For countering above problems we have come up with a idea of monitoring unit in which we can monitor temperature and humidity of products From manufacturer to Consumer at real time and hence maintain the quality of product and can stop loss of food due to quality issue We are going to implement this using DHT11/DHT22 sensor for sensing temperature and humidity, Esp8266 Wi-Fi module for Wi-Fi connectivity And GPS Neo-6m For Live tracking of product And server for transferring data to user interface made by using Blynk IoT 2.0 Application.

CHAPTER 1: INTRODUCTION

1.1 Introduction:

India is the second largest producer of fruits and vegetables, largest producer of milk and one of the leading producers of meat and fish. Owing to its diverse agro-climatic zones and resources, the production of these commodities not only extends in quantity, but also to a wide variety of them. Despite these merits, India is also one of the leading countries in terms of food loss, even though a sizable share of the population is suffering from hunger and malnutrition. The farmers in India, even though they are producing the largest quantities of the fore-mentioned agricultural and horticultural produce, their economic situation is not really presenting a happy picture. Compared to developed nations, the Indian agricultural scenario is very complex and so are the reasons leading to this situation. Among all, the important reasons leading to the high quantities of food loss are poor post-harvest care, highly complex and inefficient supply chains, lack of storage and processing infrastructure. Cold chain sector is set to play an important role in addressing these problems.

1.2 Purpose of Project:

Addressing the issue of Perishability , Cold chain extends the shelf life and thus usability of the commodity in its best form. Depending on the nature, purpose and the stage where it is employed, the application of cold temperature is divided into Frozen (<-18° C), Chilled (0°Cto 10°C), Mild Chilled (10°C to 20°C) and Normal (>20° C) storage. For most of the horticultural produce, cold chain needs to be handled at Chilled and Mild chilled zones, whereas for meat and fish the handling temperature lies between Chilled and Frozen zones. The advantages of employing Cold chain are increasing the availability of produce in lean season, increasing the affordability and accessibility by streamlining the supply chains, improving the quality of the produce, employment generation and improving the economic status of the stakeholders.

CHAPTER 2: LITERATURE SURVEY

2.1 Literature Survey:

A number of papers were referred in order to develop an IoT system based on the operations and supply chain of the organization. This section provides the summary of the papers referred. [1]The idea of how the Internet of Things can be used in the supply chain of fresh agricultural products is briefed by Zhang L. The author systematically explains how information technology can help in monitoring the whole supply chain of cold products.[2]Lieteau Discusses the design of the whole architecture of the system to implement IoT monitoring of the cold chain. The authors explain how the flow of information and material should be done to achieve the IoT solution.[3]Zhao Xiaorong describes how tracking of cold chain can be achieved with the help of wireless sensor network and cloud infrastructure. In their paper Hong- Mei Gao presents a case study of monitoring of cold chain is done in a dairy industry using the Internet of Things solution explains about agricultural products supply chain management research field based on Internet of things and Sun Xiao-Tao in his master thesis discusses how Internet of Things can be applied in agricultural products supply chain management field have dealt with IoT patent roadmap for smart logistics service provision with reference to the industry [4]Coessential have identified and describe the different interoperability mechanisms for Internet of Things integration platform.

[5]Xueta, have explained how data recorder system can be used to monitor and track the dispatch and transportation of cold chain products that requires specific values to be maintain.

2.2 Problem Statement

The retailer received an average of 70,000 orders daily all across India. The number of daily complaints amounted to almost 5000 Of these, nearly 1500 are regarding the quality of fruits and vegetables being delivered. There are a lot of complaints from a customer which is due to the product not getting delivered at the right temperature. The supply chain of the cold products is tried and tested but the operations are not quite accurately followed. In order to make sure the operations are followed and the complaints are reduced monitoring of the cold chain is required. To track the cold chain shipments, temperature of the order needs to note at every stage of the supply chain.

2.3 Objectives:

- Maintaining temperature of products in transit is especially important for pharmaceuticals food & beverages and high-value products the prime objective of cold chain monitoring system is to monitor your assets , trucks and facilities temperature and humidity so you can keep the track on cold chain supply.

- To develop a web-based application with a GUI which will be GPS enabled which will facilitate live tracking and with continuous every 10-15 min temperature sensing that will help keep an eye on cold chain supply and thus monitor it easily.

2.4 Scope of Project:

- Digital assistant :

  Digital assistant is often called chatbots and offer immediate, conversational responses to shipment information leading to higher customer satisfaction.

- Adaptive intelligence and Machine Learning:

  By applying machine learning to historical data and trends transportation management systems are able to predict transit time more accurately , plan capacity , identity at risk-shipments and much more. Enhanced artificial intelligence will also enable your TMS to provide more accurate and informed recommendations , such as alternate delivery routes during high traffic periods .

- Blockchain:

  Blockchains are now being utilized to build complex integrations among shippers , customers and carries. Applications such as intelligent track and trace increase transparency and traceability across your supply chain, but still ensure accurate and secure information.

CHAPTER 3: SYSTEM DESCRIPTION

3.1 System Description:

Below flowchart shows the system flow/ working of the project.

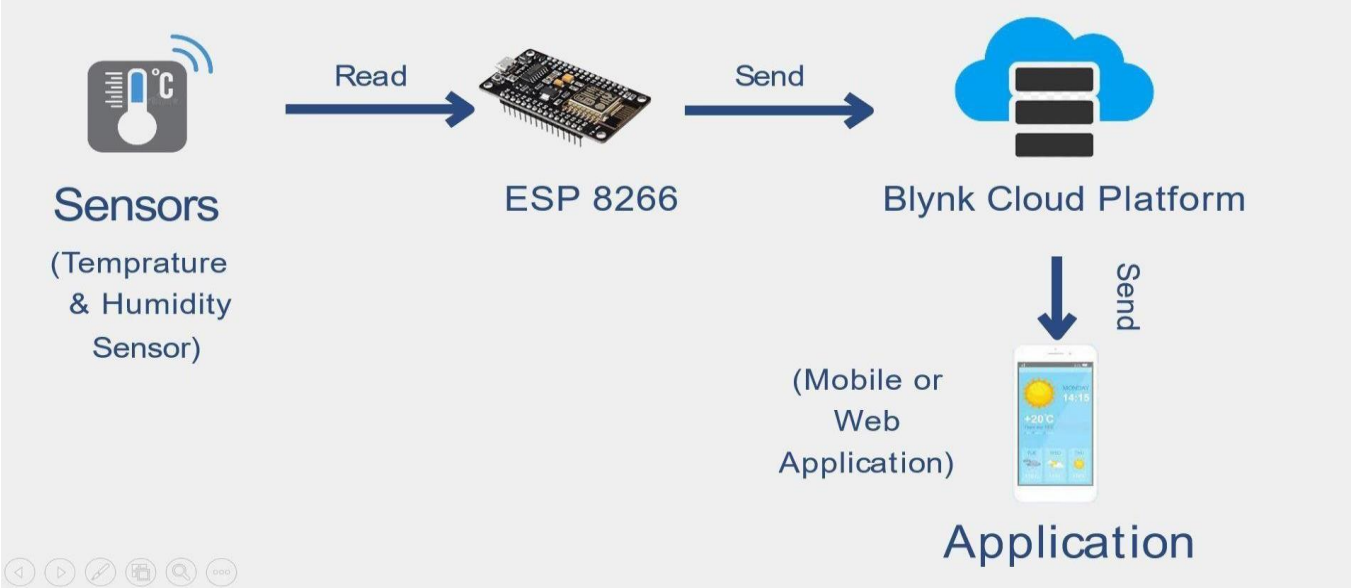


Fig: 3.1 System Flow Diagram

Description:

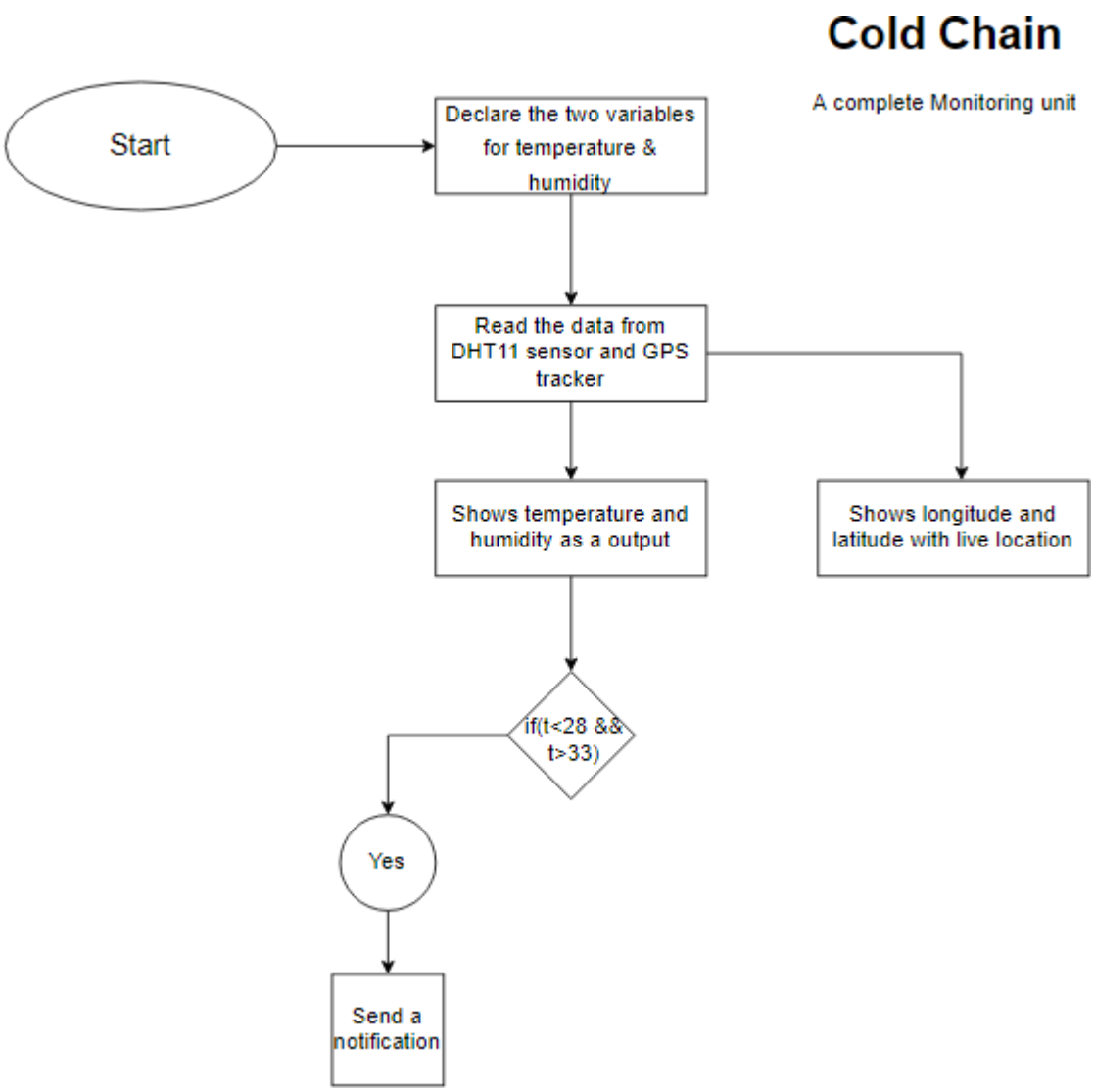
The reasons to monitoring the cold chain operations are as follows

- Make sure that the temperature of the cargo is within the range that's acceptable. Sensors are also used for sudden changes.
- Temperature-related load rejections will be minimized. Costly spoilage will be reduced and redelivery costs will also be cut.
- Critical reports will be provided for determining the location and time.
- Data can be read from fuel sensors and alarms will be sent in case of fuel loss or threat. Improper fuel invoicing must be detected and resolved and unnecessary wastage must be avoided.
- The mileage and engine hours must be tracked so that engine maintenance is decreased. Moreover, trailer lifetime can be increased as well.
- Cold chain systems lead to decreased operating costs and increased productivity. Standalone temperature recorders must be used for reliable reports.
- Transport data can be saved, sent and analyzed.
- A historical record can be kept of all temperature readings, control information and also refer to readings.

3.2 Details of Methodology:

- At first the DHT 22 sensor is going to sense temperature and humidity, Wi-Fi connectivity with the Esp8266 Wi-Fi module is going to send that sensed data to the Blynk Iot application.
- By using the Blynk IoT server we can deliver that data to user interface.
- We are going to provide ID and password to admin so that he can monitor temperature and humidity data at real time
- and past data throughout the transport of also.
- During the transport if temperature goes out of ideal temperature range then notification will pop to admin as well as driver
- So that driver can maintain the temperature. We are going to implement this using Blynk IoT (Application programming interface).
- It is GPS enabled so that Admin can track his shipment at real time on user interface. We are going to use GPS NEO 6M.
- The user interface is a Web application as well as android application.

3.3 Flowchart

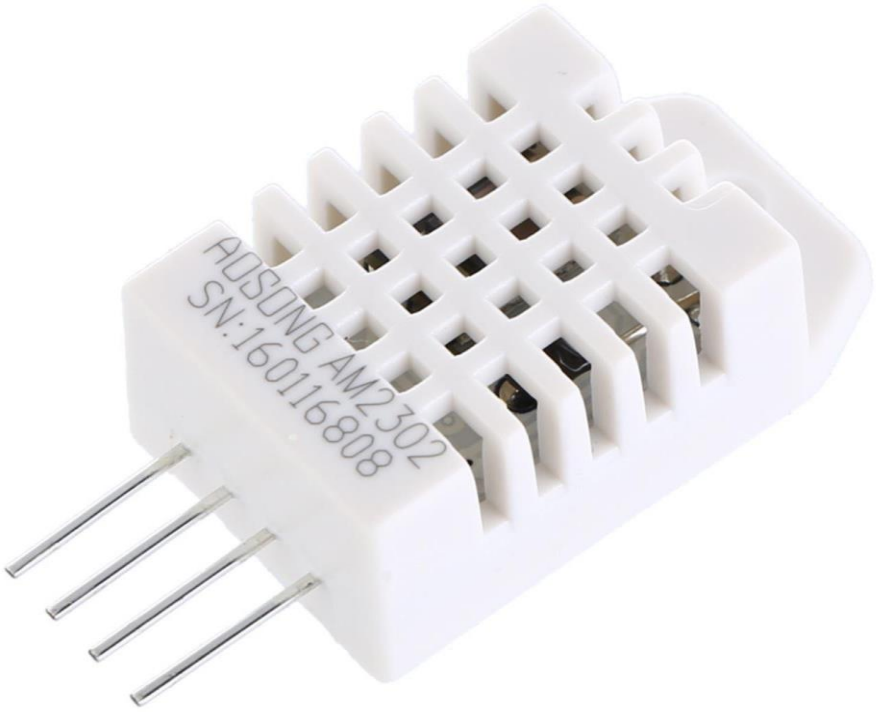


CHAPTER 4 : SOFTWARE COMPONENTS

Below are the tools and technologies that are used for implementing this project:

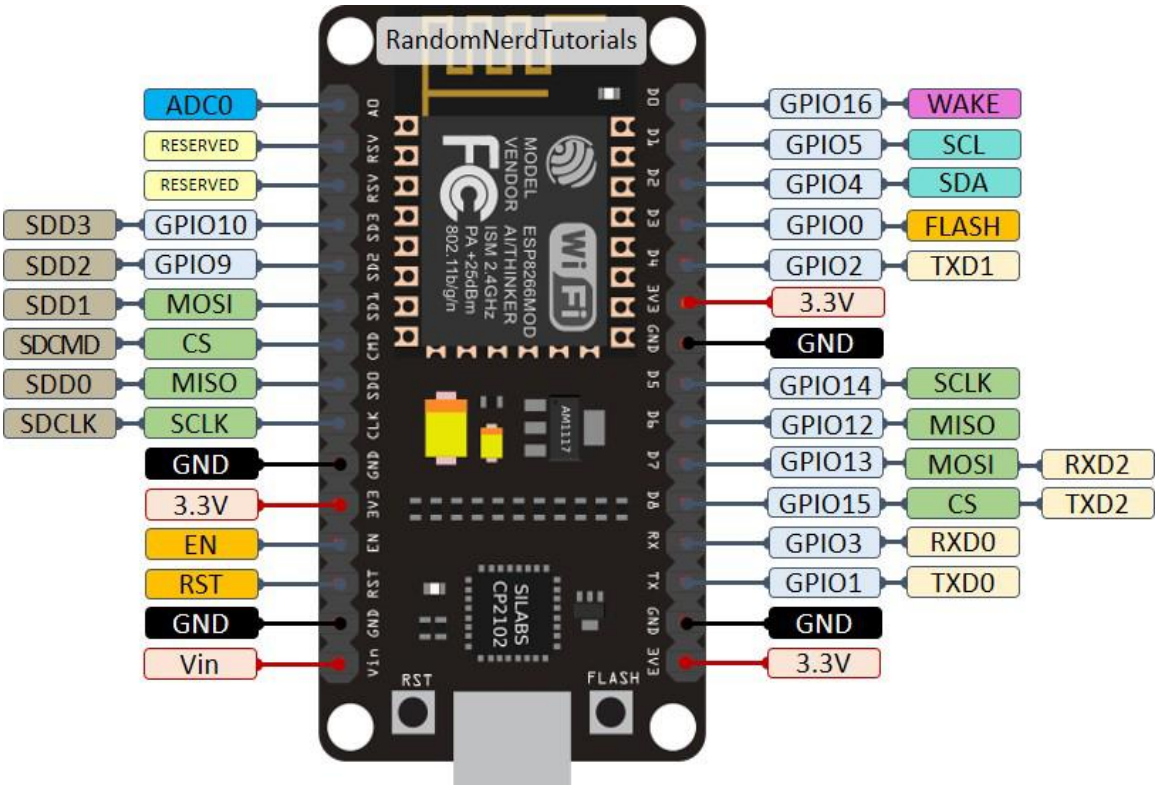
DHT 22 Temperature Sensor

- The DHT22 is a basic, low-cost digital temperature and humidity sensor.
- It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed).
- It's fairly simple to use but requires careful timing to grab data.



ESP 8266 Wi-Fi module

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106.
- Operating Voltage: 3.3V.
- Input Voltage: 7-12V.
- Digital I/O Pins (DIO): 16.
- Analog Input Pins (ADC): 1



GPS NEO 6M

- 5Hz position update rate
- Operating temperature range:

  -40 TO 85°CUART TTL socket
- EEPROM to save configuration settings
- Rechargeable battery for Backup
- The cold start time of 38 s and Hot start time of 1 s
- Supply voltage: 3.3 V
- Configurable from 4800 Baud to 115200 Baud rates. (default 9600)

Blynk IoT 2.0

- Simple APIs.
- Any hardware.
- Cloud included.
- Over-the-air updates.
- Wi-Fi provisioning

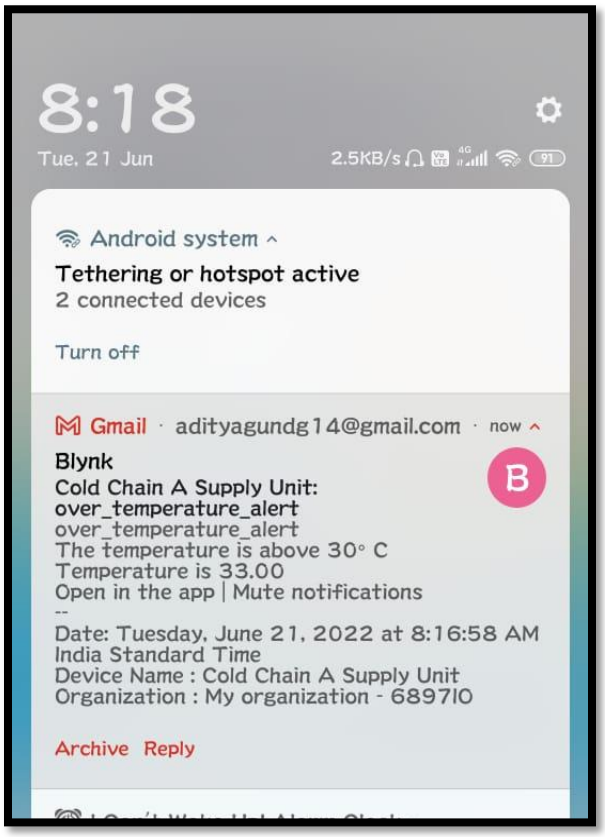
Arduino IDE

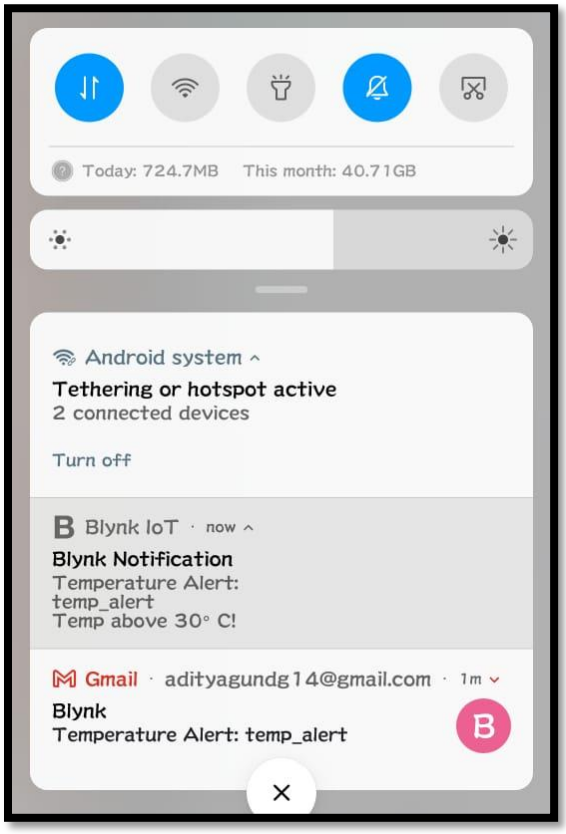
- Sketch Editing Tools.
- Libraries.
- Serial Monitor.
- Programmer Functions.
- Burn Bootloader.
- Sketches Management.
- Sharing.
- Auto Format.

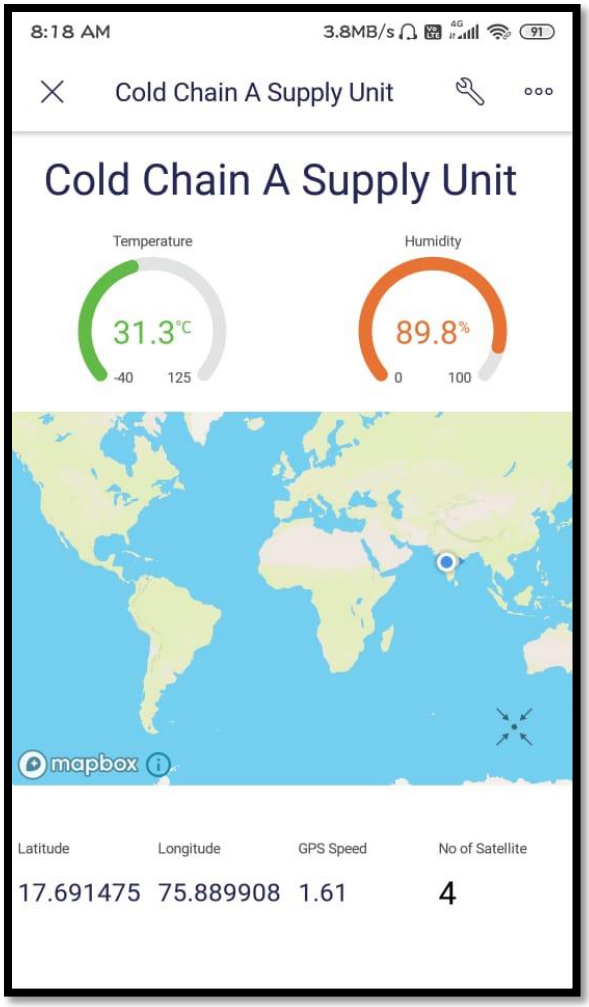
CHAPTER 5 : Output

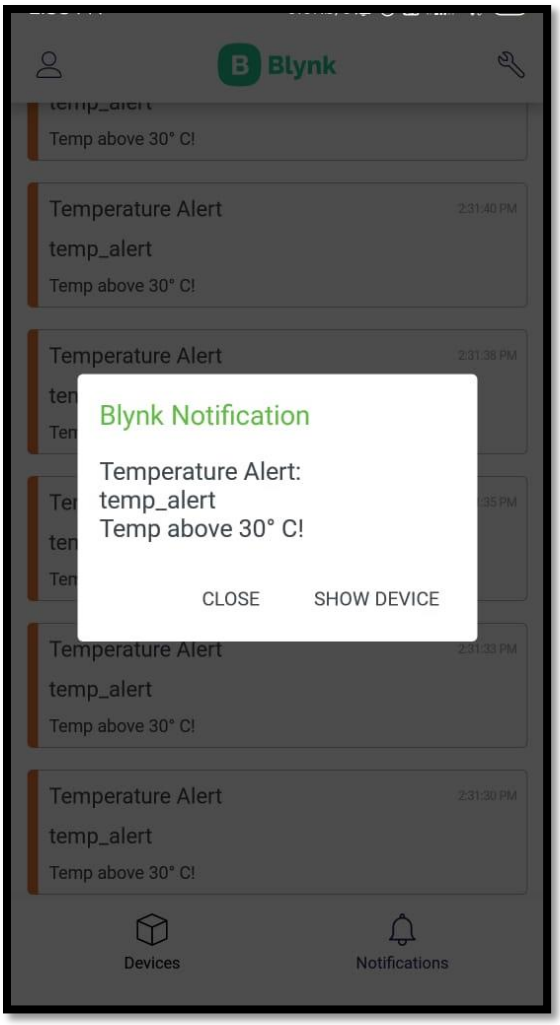
The following image shows the output of the project. In which we are used two gauges. In a first gauge it shows the temperature value in degree Celsius and another gauge shows the value of humidity in percentage. Also, we added a map which shows the location of GPS. When temperature cross the certain value(30-degree Celsius) then it sends a notification alert on mobile dashboard and mail to the user , as a Temperature is above 30Celsius.

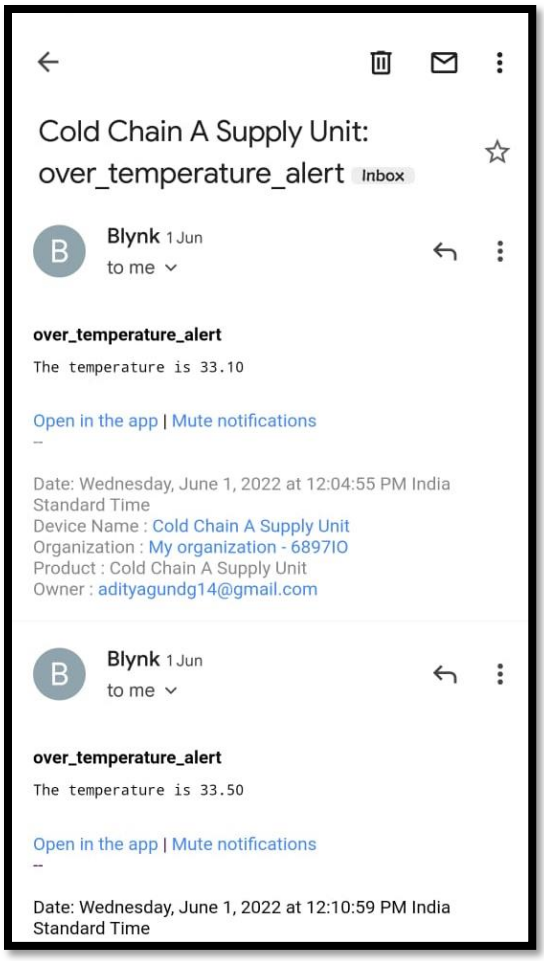
Behind the map we added a value display which shows the value of Latitude, Longitude in float format , and another value display shows the value of GPS speed and number of satellites are cached by GPS NEO 6M in integer format.






8:18 AM
3.8MB/s
Cold Chain A Supply Unit
Cold Chain A Supply Unit
Temperature
31.3°C
-40
125
Humidity
89.8%
0
100
mapbox
Latitude
Longitude
GPS Speed
No of Satellite
17.691475
75.889908
1.61
4


Blynk
Temp above 30° C!
Temperature Alert
2:31:40 PM
temp_alert
Temp above 30° C!
Temperature Alert
2:31:38 PM
Blynk Notification
Temperature Alert:
temp_alert
Temp above 30° C!
CLOSE
SHOW DEVICE
Temperature Alert
2:31:33 PM
temp_alert
Temp above 30° C!
Temperature Alert
2:31:30 PM
temp_alert
Temp above 30° C!
Devices
Notifications


Cold Chain A Supply Unit: over_temperature_alert Inbox
Blynk 1 Jun
to me
over_temperature_alert
The temperature is 33.10
Open in the app | Mute notifications
--
Date: Wednesday, June 1, 2022 at 12:04:55 PM India Standard Time
Device Name : Cold Chain A Supply Unit
Organization : My organization - 6897IO
Product : Cold Chain A Supply Unit
Owner : adityagundg14@gmail.com
Blynk 1 Jun
to me
over_temperature_alert
The temperature is 33.50
Open in the app | Mute notifications
--
Date: Wednesday, June 1, 2022 at 12:10:59 PM India Standard Time

CHAPTER 6: ADVANTAGES, DISADVANTAGES AND APPLICATION

6.1: Advantages:

1. Immediate Alerts about Anomalies: Trucks are the lifeline of any transportation business.
2. Reduced Operational Costs.
3. Increased Efficiency and Productivity.
4. Increased Customer Satisfaction.

6.2: Disadvantages:

1. Damaged cooler/freezer doors. Cooler and freezer doors that are damaged are one of the most common problems cold storage facilities faces.
2. Excessive heat exposure

CHAPTER 7: CONCLUSION

7.1 Conclusion:

The mechanism to respond to unanticipated or unpredicted events in a timely fashion will be the difference in going ahead or falling behind the competition. It is important for the organization to see the current view and prevent itself from any roadblock which may occur. Cold chain monitoring system will help the organization to change the operations quickly if the roadblock occurs. A lot of time and money will be wasted if the organization cannot identify the cause of the problems quickly and respond in a timely fashion.

Cold chain tracking requires information from all the parts of the enterprise. The data generated from the monitoring system will help the organization find how the different functions of the organization is performing. It is a real challenge to monitor the activities in a cold chain with many different parties involved. The organization needs to be able to monitor cold chain activities in an end-to-end process, from planning to production execution to the final delivery made to consumers. In this aspect, a key success factor is a focus on relevant events and information. The earlier a critical incident become sap parent, the more time there is to resolve it for a lower impact on cold chain cost and customer service levels.

7.1 Future Scope:

- For now, we sending notification alert, temperature and humidity through third party application, but our plan is to make our own user interface for good user experience.
- Now a days hiring person for customer support is time consuming and costly so that we are going to implement chatbot for customer support for great user experience. Hence it is time and cost efficient.

CHAPTER 8: Budget Details

Budget details of the project

Sr.No	Particulars	Specification/Rating	Quantity	Per unit cost (Rs.)	Total Cost (Rs.)
1	ESP8266 Wi-Fi Module	2.4 GHz Wi-Fi	1	275	275
2	DHT22 Sensor	Range: -40 to 125 degrees	1	150	150
3	GPS NEO 6M	Navigation update rate: 5Hz Tracking Sensitivity: -161 dBm	1	300	300
4	Jumping Wires	Male /Female	10	5	50
Total budget of the project					Rs.775.00

CHAPTER 9: REFERENCES

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3. Zhao Xiaorong, 'Application of IoT in agricultural products supply chain management field', Doctoral thesis, University of Victoria, 2005.
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5. Xueta (2013), 'The construction of agricultural product logistics information standardization' Master thesis, Fudan University.